

CLAIMS

1. Process for forming a protective coating containing aluminium on the surface of a metal substrate in which the said substrate and a non-gaseous precursor containing aluminium are placed in contact at a high temperature with an atmosphere containing an active gas which reacts with the precursor to form a gaseous aluminium compound which decomposes on contact with the substrate depositing aluminium metal thereon, characterised in that the said atmosphere contains a gaseous compound of a modifier metal which decomposes on contact with the substrate and deposits the said modifier metal thereon simultaneously with the deposition of aluminium.
2. Process according to claim 1, in which the said modifier metal is selected from zirconium, hafnium and yttrium.
3. Process according to claim 1, in which the said active gas at least in part comprises the said gaseous compound.
4. Process according to claim 2, in which the said active gas at least in part comprises the said gaseous compound.
5. Process according to claim 3, in which the said active gas solely comprises the said gaseous compound.
6. Process according to claim 3, in which the said active gas also contains at least one ammonium compound.
7. Process according to claim 1, in which the said active gas and/or the said gaseous compound are formed by the

vaporisation of at least one substance which is solid at ambient temperature mixed with the said precursor.

8. Process according to claim 1, in which the substrate contains at least one element which combines with the aluminium to form an intermetallic compound within the coating in which the aluminium is partly substituted by the modifier metal.

9. Process according to claim 7, in which the said element of the substrate is nickel and the said intermetallic compound is  $\beta$ -NiAl.

10. Process according to claim 1, in which the substrate is a nickel-based superalloy.

11. Process according to claim 1, in which the said active gas and/or the said gaseous compound contain at least one halogen.

12. Process according to claim 10, in which the said gaseous compound is at least one compound selected from  $\text{ZrCl}_4$ ,  $\text{ZrOCl}_2$  and  $(\text{NH}_4)_2\text{ZrF}_6$ .

13. Process according to claim 11, in which the said active gas contains at least one compound selected from  $\text{NH}_4\text{Cl}$ ,  $\text{NH}_4\text{F}$  and  $\text{NH}_4\text{F}, \text{HF}$ .

14. Process according to claim 12, in which the said active gas contains at least one compound selected from  $\text{NH}_4\text{Cl}$ ,  $\text{NH}_4\text{F}$  and  $\text{NH}_4\text{F}, \text{HF}$ .

15. Process according to claim 1, in which the said precursor is an alloy of aluminium and chromium.
16. Process according to claim 1, in which the substrate and the precursor are at a distance from each other.
17. Process according to claim 16, in which the substrate is located above the precursor.
18. Process according to claim 1, in which the substrate and the precursor are in contact.
19. Process according to claim 1, in which the substrate and the precursor are located in an enclosure permitting only limited exchanges with the exterior.
20. Process according to claim 1, in which in addition to the active gas and the gaseous compound the said atmosphere comprises an inert or reducing gas and preferably hydrogen.
21. Process according to claim 1, in which the modifier element is present in the said protective coating in a concentration by mass of less than 0.5%.
22. Process according to claim 21, in which the said concentration by mass lies between 500 and 1000 ppm and is preferably approximately 800 ppm.
23. Process according to claim 1, in which the said high temperature lies between 950 and 1200°C and is preferably approximately 1080°C.